Aeronautical Systems Center

Dominant Air Power: Design For Tomorrow…Deliver Today

Real-time, Emulative, Terminal Model Applications of Legacy and Advanced Tactical Data Links for Use in LVC Assessments

ITEA LVC Conference Jan 2009

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Cleared for Public Release by ASC Public Affairs. Disposition Date: 6 Nov 2008 Case #: 88ABW-2008-0882

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JAN 2009		**00-00-2009 to 00-00-2009**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Real-time, Emulative, Terminal Model Applications of Legacy and Advanced Tactical Data Links for Use in LVC Assessments	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **ASC/RA (SIMAF),Wright Patterson AFB,OH,45433**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**15**	

Outline

- **Why High Fidelity, Real-Time Data Link Modeling?**
- **Terminal Model Application Discussion**
  - Link 16
  - Tactical Targeting Network Technologies (TTNT)
  - Flexible Access Secure Transfer (FAST)
- **Analyses**
  - Objective Gateway, Increment 1 Study
  - Persistent Fires 09-01

SIMAF Mission/Vision

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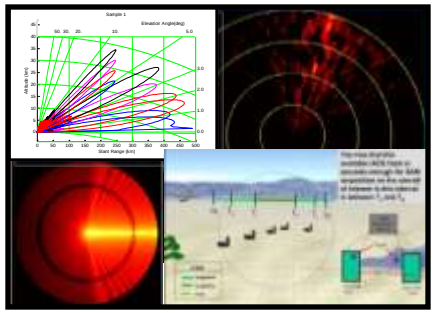
Mission: SIMAF provides a real-time, high-fidelity, virtual and constructive synthetic battlespace analysis capability to evaluate:

Human System Interfaces

Strategies, CONOPS & TTPs

Network-Enabled War-fighting Capabilities

Emerging Technologies



Current & Future Weapon Systems

Vision: To be a preferred DOD center for independent assessment using modeling, simulation and analysis throughout the acquisition life cycle

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Goal:

Seamless, Continuous Application of LVC Throughout Acquisition

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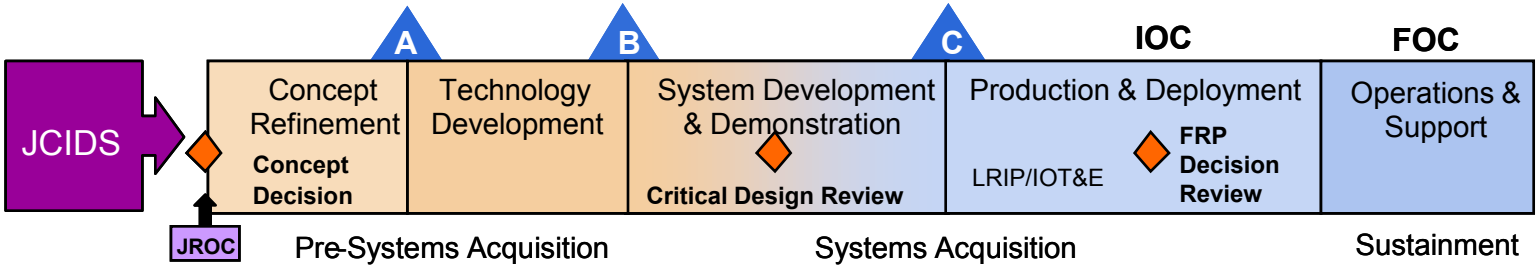
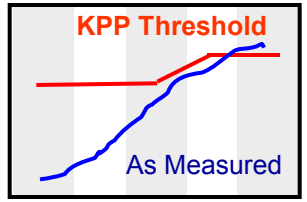


Capability Under Development
- Live Systems
- Virtual Representations
- Constructive Representations

Assessment 1
Mission Capability measured against KPP(s)

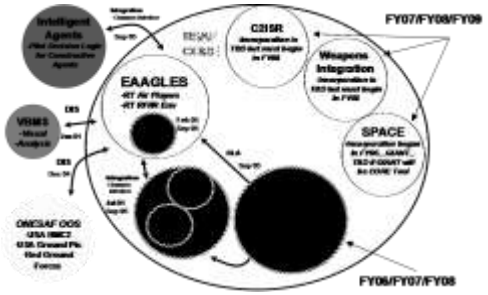
Assessment X
Mission Capability measured against KPP(s)



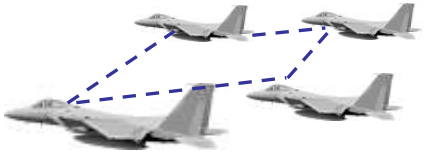
Assessment criteria based upon capability metrics

LVC Mission Environment

LVC Mission Environment



3 Continuous Assessment Process



Tool Suite Employment

Tool Suite Development

2 Pull tools forward for application across the Life Cycle

1 Design for test

Network Enabled Warfare

Applied with a Capability Focus

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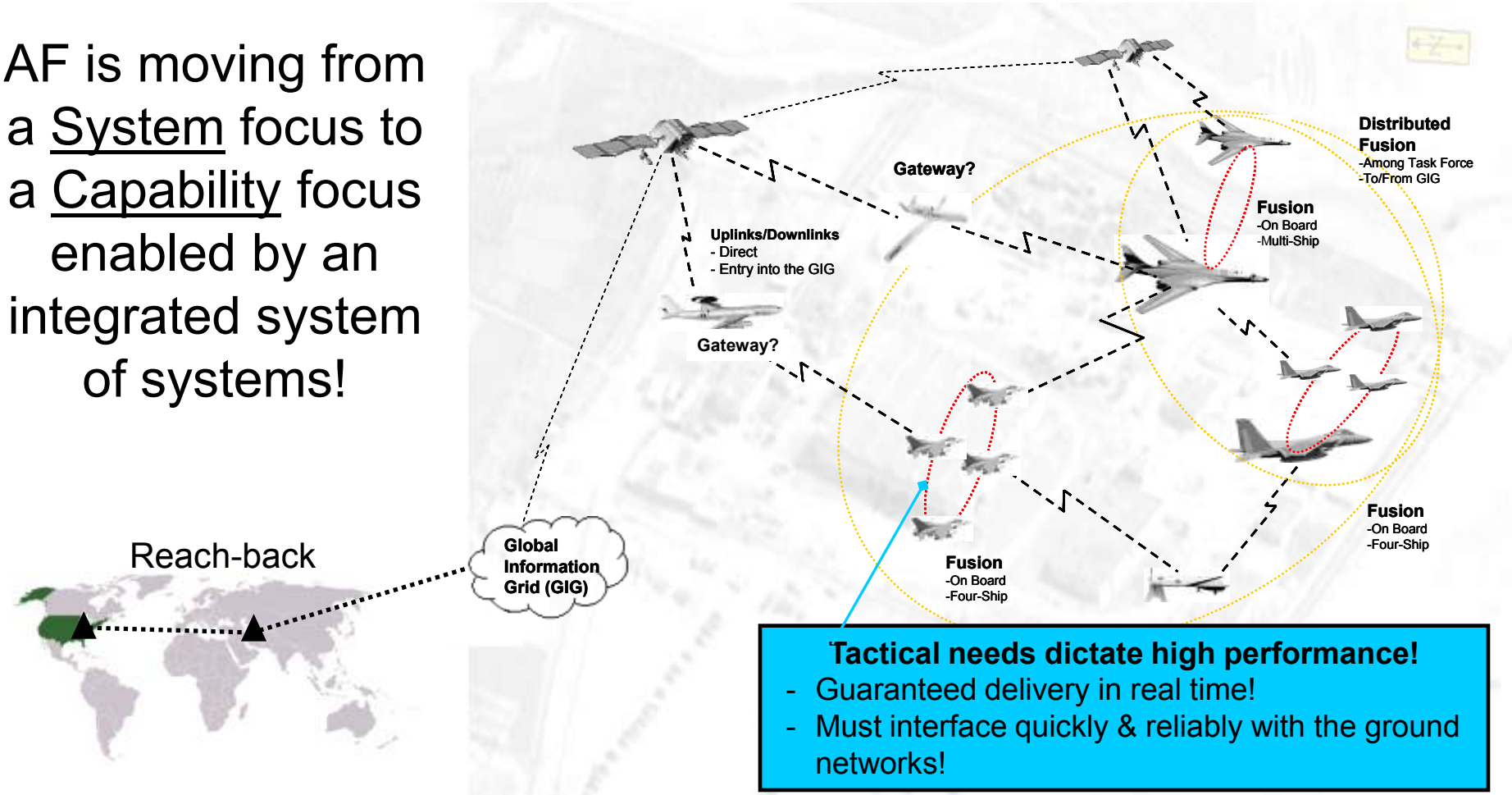
AF is moving from a <u>System</u> focus to a <u>Capability</u> focus enabled by an integrated system of systems!



Tactical needs dictate high performance!
- Guaranteed delivery in real time!
- Must interface quickly & reliably with the ground networks!

Information is Agnostic! It doesn't care what network it resides within….and neither do we!

What's the Solution?

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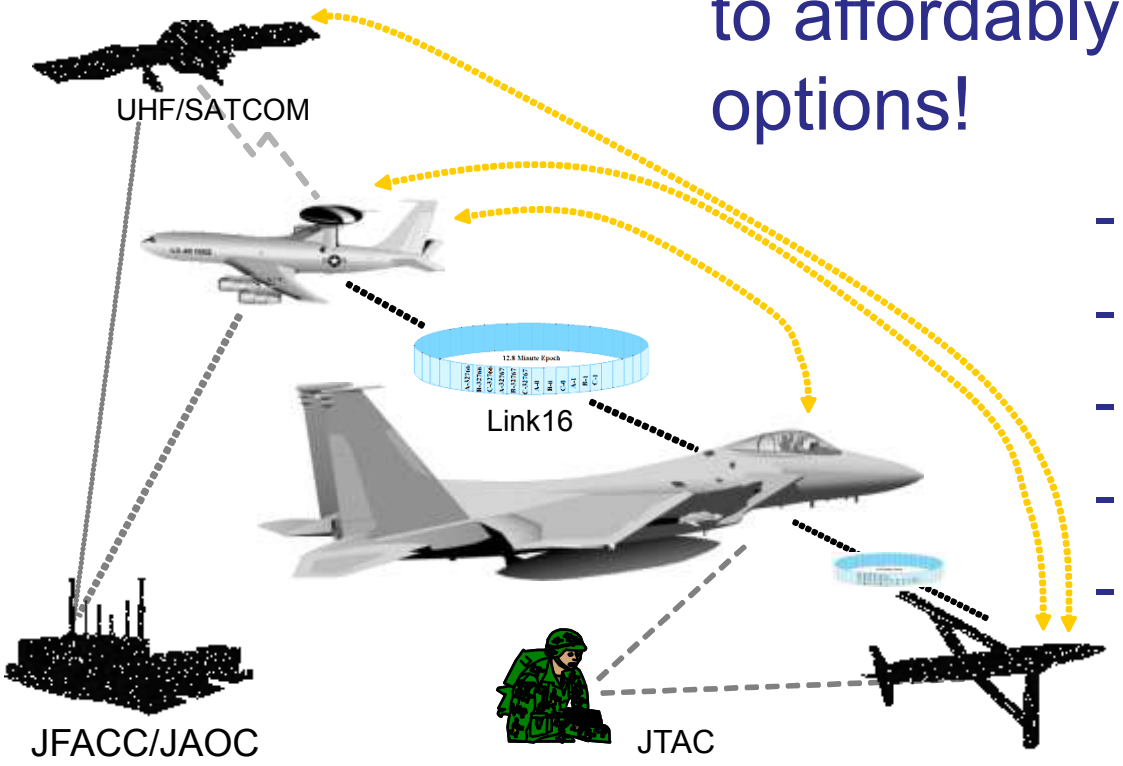

Use of Distributed Simulation to affordably assess capability options!

- Scale & Repeatability
- Testing Limitations
- Operational Issues
- Range Limitations
- Cost

A Good Business Case!

The cross domain nature of the problem lends itself to teaming to address the many "sensor to C2 to shooter to weapon" permutations!

Environment Requirements

Requirement Definition

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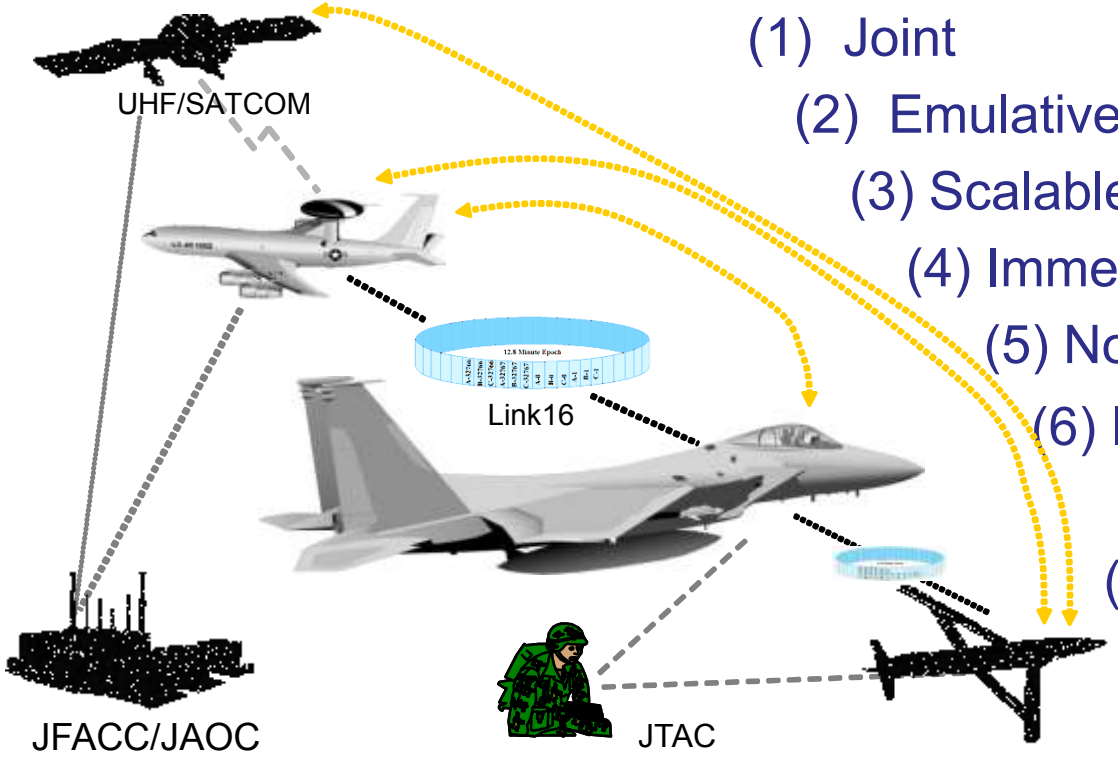

(1) Joint

(2) Emulative

(3) Scalable

(4) Immersive

(5) Non-Proprietary

(6) Interoperable with Test tools

(7) Reusable

Environment must include electronic warfare and emulative quality nets!

Build for Test Range Application!

A large number of diverse blue force systems (including EW) integrated with diverse networks operating over multiple domains (tactical edge, C2, munitions) in real-time within a hostile environment!

What is High Fidelity, Real-Time Data Link Modeling?

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Real Time: Simulation Time = Wall Clock

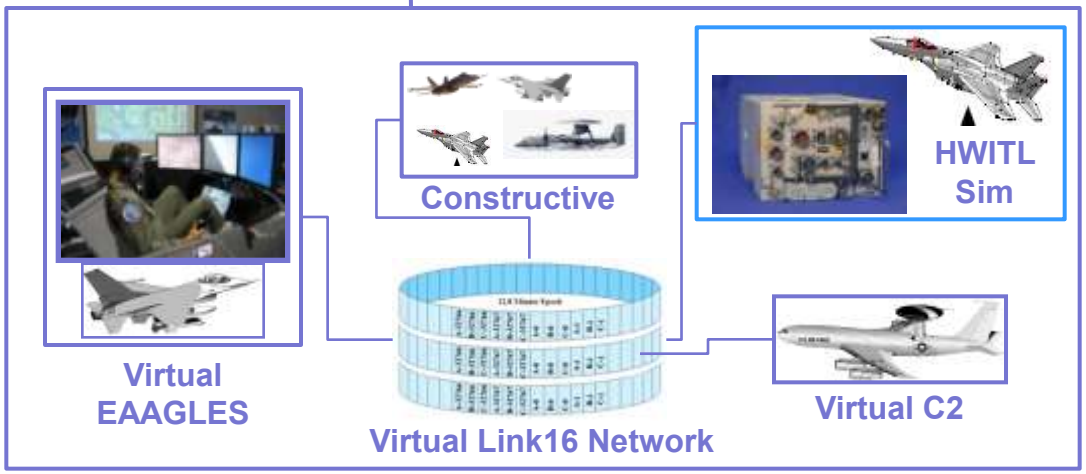
(Example: 1 second sim time = 1 sec wall clock time)

Allows interoperability with live hardware and human-in-the-loop

Emulative: A model that can interoperate seamlessly with live hardware through the use of actual systems' protocols or inputs and the capability to operate in the simulated system's actual environment

Terminal Model Application: A stand-alone executable, C++ (EAAGLES-based) software application designed to provide interfaces analogous to data link terminal hardware. Explicitly limits simulation-induced assumptions

Real-Time, Emulative, Terminal Model Applications of Tactical Data Links for Use in LVC Assessments



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EAAGLES

***E**xtensible **A**rchitecture for **A**nalysis and **G**eneration of **L**inke**d** **S**imulations*

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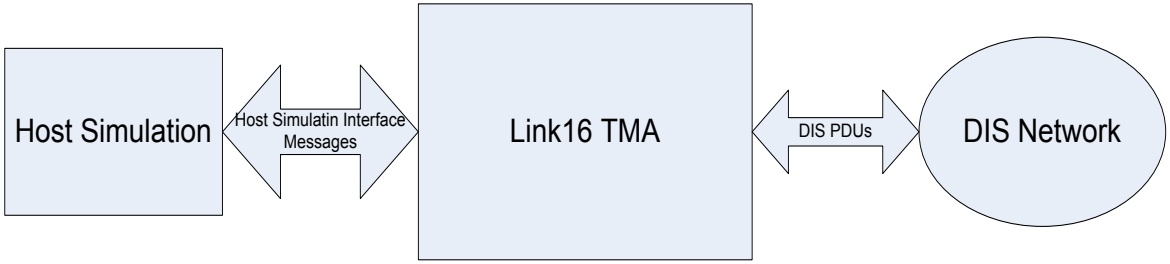
- ❑ Capability-Based Design
- ❑ Electronic combat environment
- ❑ Robust air-to-air *and* air-to-ground
- ❑ Designed for hundreds of players

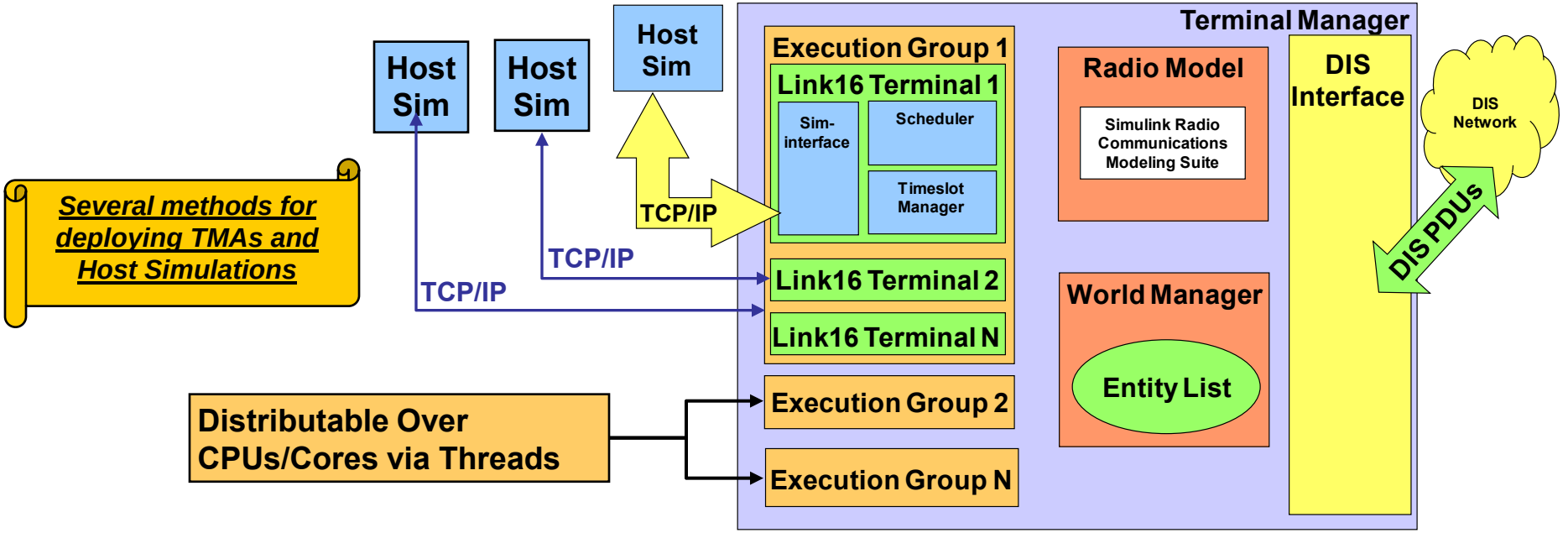
- ❑ *Proven* real-time architecture (FY03-FY06)
- ❑ Optimized for the PC, yet platform independent
- ❑ Variable and Scalable Fidelity, Object Oriented
- ❑ Hardware: Dual to Networked PC "clusters"
- ❑ Hardware-in-the-Loop
- ❑ Distributed simulation via DIS and HLA
- ❑ Government owned and managed software

Link16 Terminal Model Application

- Compliant with SISO Standard 2.9.6 (TADIL-TALES)
  - Signal and Transmitter DIS PDUs which contain additional Link16 specific information
  - SISO TSA Fidelity Level 2
- Timeslot rate is very accurate
  - Timeslots are not "clumped"
- Easy to connect to via other simulators
- Realistic RF propagation characteristics
  - Matlab/Simulink Radio Communications Model



Multiprocessor Capable



Link16 Terminal Model Application

Distributed V&V

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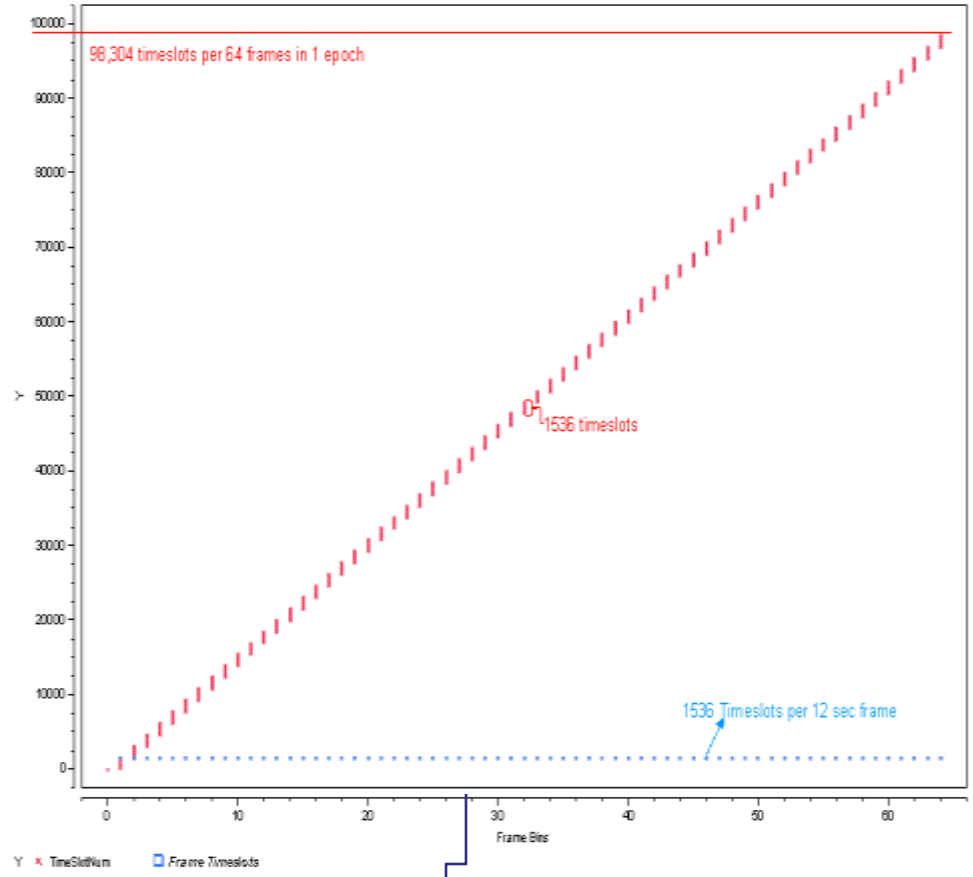
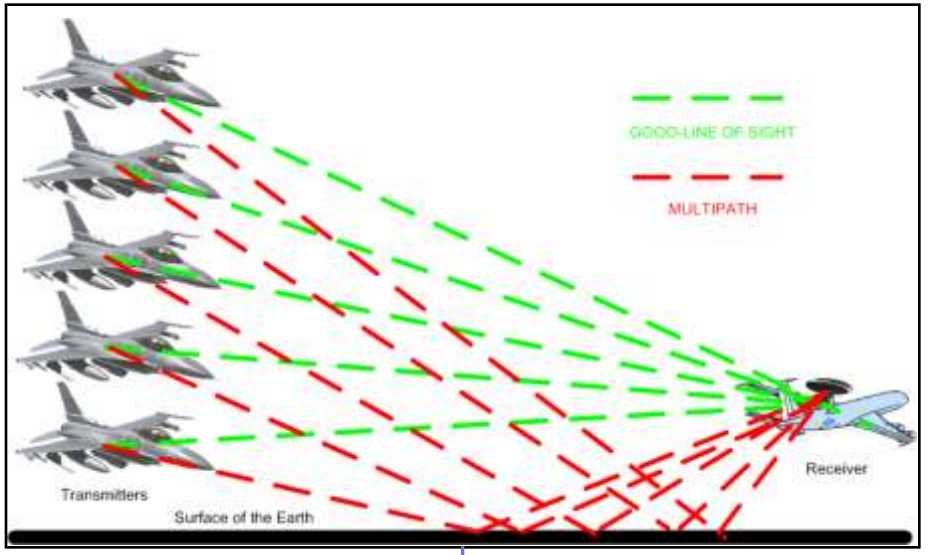
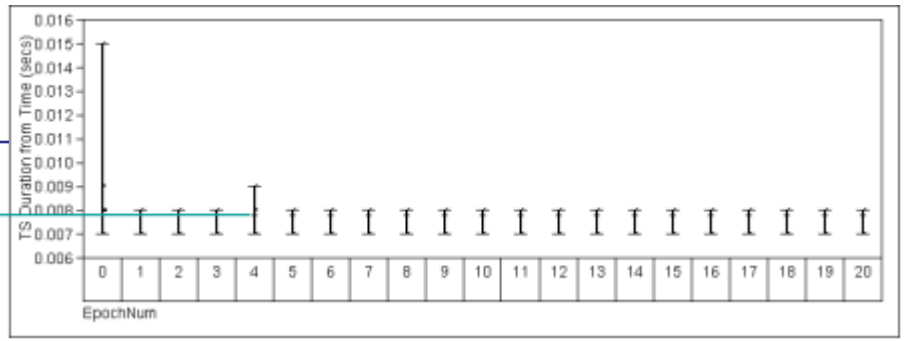




RF Propagation

Link16 Timing Maintained Across a Physical Network

**Subject to Network Latency Limitations*



TTNT Terminal Models

Internal Structure

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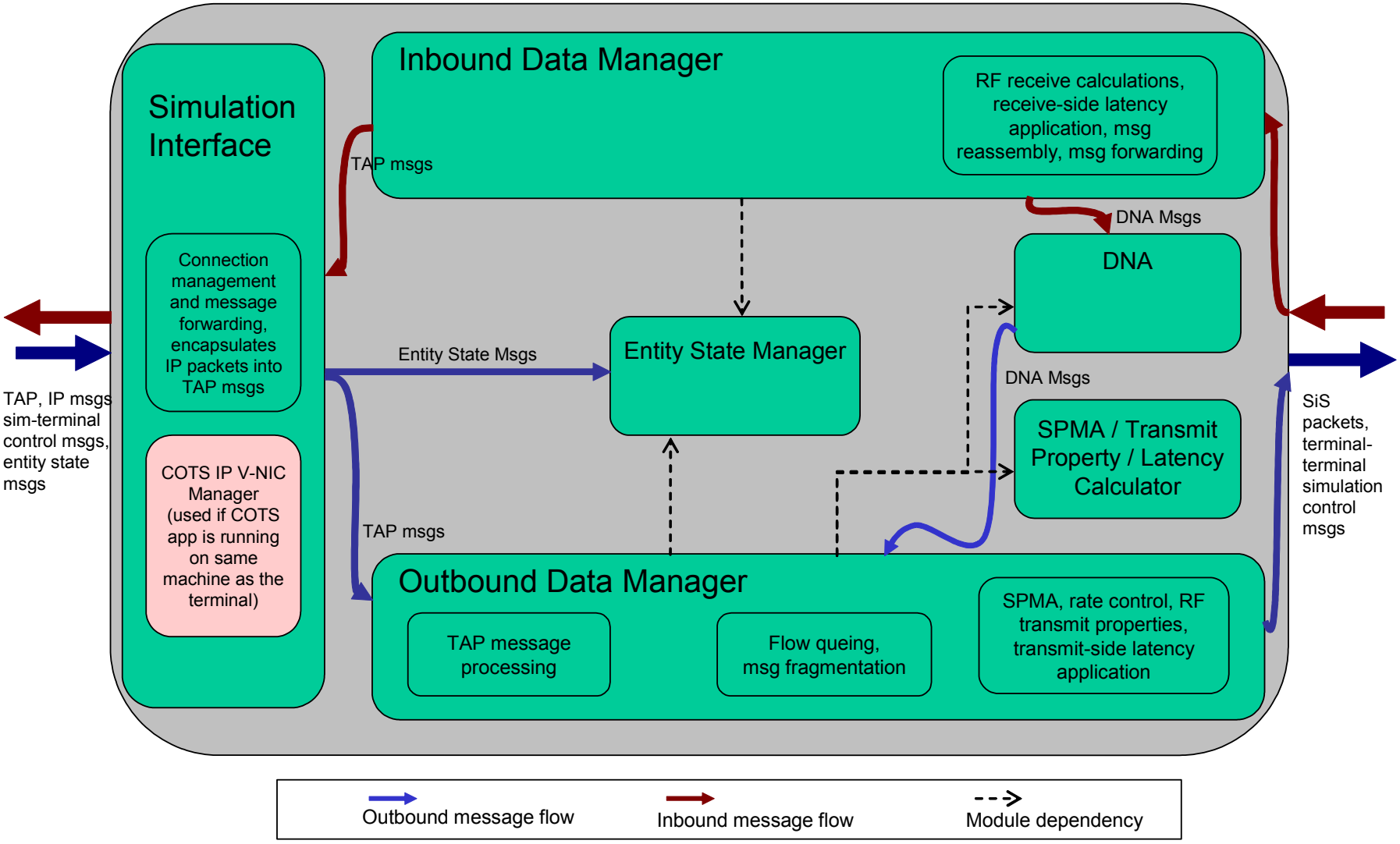

TTNT Terminal Models Deployed on HPC

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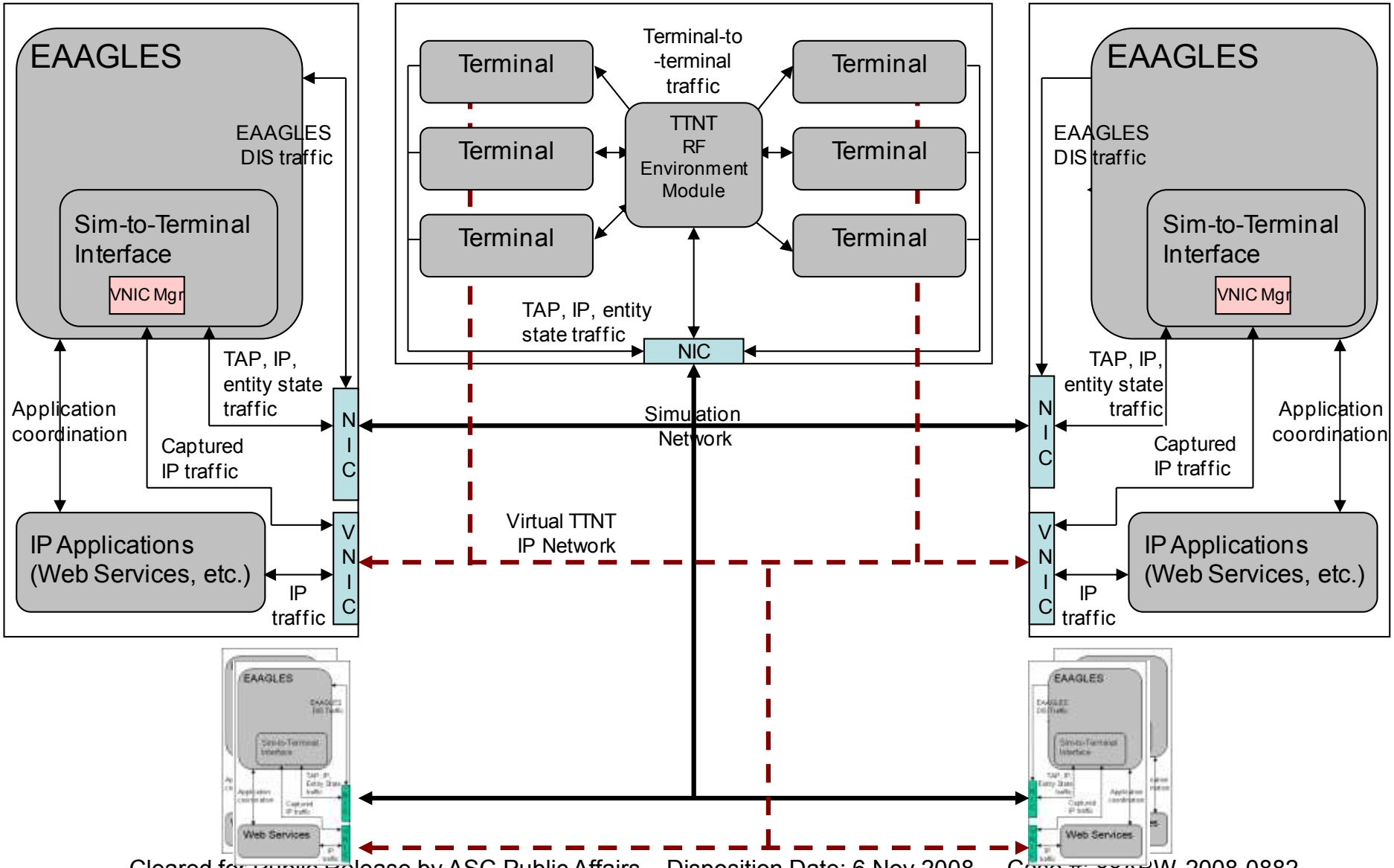

FAST Terminal Model Application

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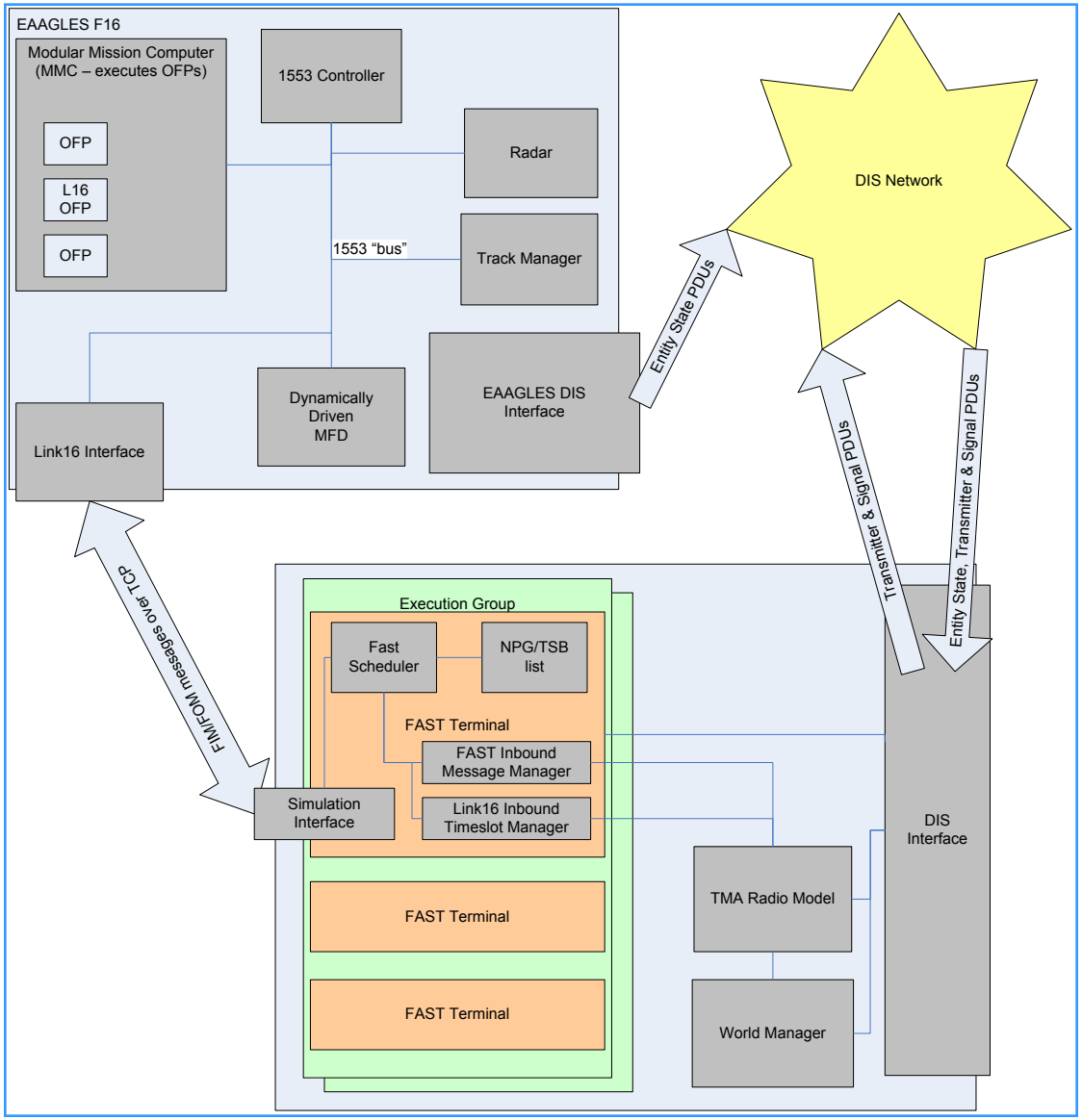

Explicit Interface from Host Sim to FAST Terminal Simulation

Extends TADIL-TALES Standard for Link16 over DIS

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